# CONTENTS


| | Page |
|---|---|
| Foreword. B. T. GALLOWAY | i |
| Citrus Ichangensis, a Promising, Hardy, New Species from Southwestern China and Assam. WALTER T. SWINGLE | 1 |
| Cysticercus Ovis, the Cause of Tapeworm Cysts in Mutton. B. H. RANSOM | 15 |
| The Serpentine Leaf-Miner. F. M. WEBSTER and T. H. PARKS | 59 |
| The Occurrence of a Cotton Boll Weevil in Arizona. W. DWIGHT PIERCE | 89 |
| The Diagnosis of Dourine by Complement Fixation. JOHN R. MOHLER, ADOLPH EICHHORN, and JOHN M. BUCK | 99 |
| Three Undescribed Heart-Rots of Hardwood Trees, Especially of Oak. W. H. LONG | 109 |
| Individual Variation in the Alkaloidal Content of Belladonna Plants. ARTHUR F. SIEVERS | 129 |
| The Pubescent-Fruited Species of Prunus of the Southwestern States. SILAS C. MASON | 147 |
| Selective Adsorption by Soils. E. G. PARKER | 179 |
| A Bacterium Causing a Disease of Sugar-Beet and Nasturtium Leaves. NELLIE A. BROWN and CLARA O. JAMIESON | 189 |
| The Calliephialtes Parasite of the Codling Moth. R. A. CUSHMAN | 211 |
| Polyporus Dryadeus, a Root Parasite on the Oak. W. H. LONG | 239 |
| The Foot-Rot of the Sweet Potato. L. L. HARTER | 251 |
| Environmental Influences on the Physical and Chemical Characteristics of Wheat. J. A. LE CLERC and P. A. YODER | 275 |
| A Drought-Resisting Adaptation in Seedlings of Hopi Maize. G. N. COLLINS | 293 |
| Some Diseases of Pecans. FREDERICK V. RAND | 303 |
| A Twig Blight of Quercus Prinus and Related Species. DELLA E. INGRAM | 339 |
| New Potato Weevils from Andean South America. W. DWIGHT PIERCE | 347 |
| An Undescribed Species of Gymnosporangium from Japan. W. H. LONG | 353 |
| The Presence of Some Benzene Derivatives in Soils. EDMUND C. SHOREY | 357 |

Page

Indicator Significance of Vegetation in Tooele Valley, Utah. T. H. KEARNEY, L. J. BRIGGS, H. L. SHANTZ, J. W. MCLANE, and R. L. PIEMEISEL ..... 365

Citropsis, a New Tropical African Genus Allied to Citrus. WALTER T. SWINGLE and MAUDE KELLERMAN ..... 419

Winter Spraying with Solutions of Nitrate of Soda. W. S. BALLARD and W. H. VOLCK ..... 437

Tyloses, a Study of Their Occurrence and Practical Significance in Some American Woods. ELOISE GERRY ..... 445

The Cambium Miner in River Birch. CHARLES T. GREENE ..... 471

A Study of Some Imperfect Fungi Isolated from Wheat, Oat, and Barley Plants. EDWARD C. JOHNSON ..... 475

The Origin of Some of the Streptococci Found in Milk. L. A. ROGERS and ARNOLD O. DAHLBERG ..... 491

Crystallization of Cream of Tartar in the Fruit of Grapes. WILLIAM B. ALWOOD ..... 513

The Reduction of Arsenic Acid to Arsenious Acid by Thiosulphuric Acid. ROBERT M. CHAPIN ..... 515

Index ..... 519

ERRATA

Page 2, footnote, line 1, "augustis" should read "angustis."
Page 2, footnote, line 2, "ate" should read "late."

Page 28, line 30, "Taenia ovis (Cobbold, 1869) Ransom, n. comb., 1913," should read "Taenia ovis (Cobbold, 1869), Ransom, 1913."

Page 98, line 5, "Figs. 3 and 7.—Side and dorsal views of female" should read "Figs. 3 and 7.—Side and dorsal views of male. Figs. 4 and 8.—Side and dorsal views of female."

Page 176, line 19, "Prunus havardii W. F. Wight, n. comb." should read "Prunus havardii (W. F. Wight), n. comb."

Page 421, footnote, line 2, "locularis" should read "locularibus."
Page 421, footnote, line 7, "locularis" should read "loculare."

Page 425, figure 4, "gabonensis" should read "gabunensis."

# ILLUSTRATIONS

PLATES


| PLATE | | Page |
|---|---|---|
| I. | *Citrus ichangensis* Swingle: The type specimen from Hsing-shan District, Hupeh Province, China. | 14 |
| II. | Fig. 1.—*Cysticercus ovis* from lamb which had been fed eggs of *Taenia ovis*. Fig. 2.—*Cysticercus cellulosae*. Fig. 3.—*Taenia ovis*. Fig. 4.—*Taenia hydatigena* (*T. marginata*) from an imported sheep dog. Fig. 5.—*T. hydatigena* (*T. marginata*) from a dog which had been fed *Cysticercus tenuicollis* | 58 |
| III (colored). | Figs. *A* and *B*.—Portions of muscle of sheep showing *Cysticercus ovis* (undegenerated) in situ. Fig. *A*.—Section of hind leg showing two "deep" cysticerci. Fig. *B*.—Hind leg showing three "superficial" cysticerci. Figs. *C* and *D*.—Heart and portion of diaphragm of sheep showing *Sarcocystis* nodules likely to be mistaken for degenerate cysticerci. Fig. *E*.—Sheep heart showing numerous small degenerate cysticerci (*Cysticercus ovis*). | 58 |
| IV. | Fig. 1.—Carcass of sheep showing a degenerate cyst of *Cysticercus ovis* at the point indicated by the penknife. Fig. 2.—Degenerate cysts of *Cysticercus ovis* in muscle of sheep; portion of carcass shown in Plate III, figs. *A* and *B*. | 58 |
| V. | Leaves of different species, showing the work of the serpentine leaf-miner (*Agromyza pusilla*). Fig. 1.—Mines in a leaf of rape. Fig. 2.—Mines in leaves of white clover. Fig. 3.—Mines in leaves of alfalfa | 88 |
| VI. | Figs. 1, 2, 5, and 6.—*Anthonomus grandis thurberiae:* Type specimens. Figs. 1 and 5.—Side and dorsal views of male. Figs. 2 and 6.—Side and dorsal views of female. Figs. 3, 4, 7, and 8.—*Anthonomus grandis*. Typical specimens. Figs. 3 and 7.—Side and dorsal views of male. Figs. 4 and 8.—Side and dorsal views of female. Fig. 9.—*Thurberia thespesioides:* Section of boll, showing cell of *Anthonomus grandis thurberiae*. Fig. 10.—*Thurberia thespesioides:* Seed, showing cell of *Anthonomus grandis thurberiae*. Fig. 11.—*Thurberia thespesioides:* Boll, showing egg puncture of *Anthonomus grandis thurberiae*. | 98 |
| VII. | Fig. 1.—*Polyporus pilotae:* A sporophore on the end of a white-oak log from Arkansas. Fig. 2.—*Polyporus pilotae:* Rot appearing in the butt of a white-oak log from Arkansas, showing the holes and white cellulose areas characteristic of this rot in a cross section of a living oak. Fig. 3.—*Polyporus pilotae:* Radial-longitudinal view of a white-oak log from Arkansas, showing the honeycomb type of the rot with the white cellulose lines and elliptical hollows. Fig. 4.—*Polyporus pilotae:* Rot occurring in a log of *Castanea pumila* from Arkansas; *A*, concentric layers of the rotted wood; *B*, white cellulose fibers. Fig. 5.—*Polyporus pilotae:* Cross section of a chestnut log from New York, showing the central circular rotted zone. Fig. 6.—*Polyporus pilotae:* Radial-longitudinal view of the rot in a chestnut log from New York, showing the white pocketed stage. | 128 |

Page

PLATE VIII. Fig. 1.—*Polyporus pilotae:* Radial-longitudinal view of the rot in a chestnut log from New York. Fig. 2.—*Polyporus berkeleyi:* Radial-longitudinal view of the rot in white-oak timber from Arkansas, showing the string and ray form characteristic of its second stage. Fig. 3.—*Polyporus berkeleyi:* A sporophore on a white-oak root from Arkansas. Fig. 4.—*Polyporus frondosus:* A sporophore on roots of white oak from Arkansas..... 128

IX. Fig. 1.—*Prunus texana:* Better quality of fruit. Fig. 2.—*Prunus texana:* Fruiting bush, 2 meters in diameter. Fig. 3.—*Prunus texana:* Seeds; three scraped clean of pile..... 178

X. Fig. 1.—*Prunus texana* hybrid, hort. var. *Stuart:* Fruit and leaves. Fig. 2.—*Prunus texana* hybrid, hort. var. *Stuart:* Tree in first leaf. Fig. 3.—*Prunus texana* hybrid, hort. var. *Johnson:* Fruiting branch..... 178

XI. Fig. 1.—*Prunus andersonii:* Plant, showing taproot. Fig. 2.—*Prunus andersonii:* Flowering branch. Fig. 3.—*Prunus andersonii:* Types of seeds..... 178

XII. Fig. 1.—*Prunus andersonii:* Tangled thickets, the more common form. Fig. 2.—*Prunus andersonii:* Treelike specimen, 3 meters high. Fig. 3.—*Prunus eriogyna*, n. sp.: Erect, large-leaved form of plant..... 178

XIII. Fig. 1.—*Prunus eriogyna*, n. sp.: Common form of plant. Fig. 2.—*Prunus eriogyna*, n. sp.: Variable fruits and seeds. Fig. 3.—*Prunus eriogyna*, n. sp.: Fruiting branch..... 178

XIV. Fig. 1.—*Prunus eriogyna*, n. sp.: Seedlings. Fig. 2.—*Prunus fasciculata:* Growth in flood-swept wash ..... 178

XV. *Prunus minutiflora:* Fruiting branch..... 178

XVI. *Prunus havardii:* Fruiting branch of the type specimen..... 178

XVII. Fig. 1.—Sugar-beet leaves inoculated with *Bacterium aptatum*. Fig. 2.—Sugar-beet root inoculated with *Bacterium aptatum*..... 210

XVIII (colored). Nasturtium leaves showing bacterial leaf spots 10 days after inoculation with *Bacterium aptatum*..... 210

XIX. Fig. 1.—Bean leaves inoculated with *Bacterium aptatum* from leaf-spot of sugar beet. Fig. 2.—Nasturtium leaves inoculated with *Bacterium aptatum* from leaf-spot of sugar beet. Fig. 3.—Bean pods inoculated with *Bacterium aptatum* from leaf-spot of sugar beet..... 210

XX. *Calliephialtes* sp. Fig. 1.—Female. Figs. 2 and 3.—Characteristic positions assumed by the insect in oviposition. Fig. 4.—Male..... 238

XXI. Fig. 1.—*Polyporus dryophilus:* A median-longitudinal section of a sporophore on *Quercus alba* from Arkansas, showing the granular core and the white mycelial lines in the central and rear portion. Fig. 2.—*Polyporus dryophilus:* Side view of the ungulate type of sporophore on *Quercus californica* from California. Fig. 3.—*Polyporus dryophilus:* Median-longitudinal section of the globose type of sporophore on *Quercus garryana* from California, showing the large granular core and prominent white mycelial lines. Fig. 4.—*Polyporus dryadeus:* Median-

Page

longitudinal view of a young sporophore on *Quercus texana* from Texas, showing the fibrous, nongranular nature of the context. Fig. 5.—*Polyporus fulvus* Fries: Median-longitudinal view of a sporophore on *Quercus* sp. from Sweden, showing the granular core characteristic of *P. dryophilus*. Fig. 6.—*Polyporus vulpinus:* Median-longitudinal view of sporophore on *Populus* sp. from Sweden, showing the granular core characteristic of *P. dryophilus*. Fig. 7.—*Polyporus dryophilus:* Front view of the applanate type of a sporophore on *Populus tremuloides* from Colorado, showing the faint zones on the pileus where the hairs have disappeared. Fig. 8.—*Polyporus dryophilus:* Median-longitudinal view of sporophore on *Populus tremuloides* from Colorado, showing the granular core originating between the sapwood and bark and extending into the center of the sporophore..... 250

PLATE XXII. Fig. 1.—*Polyporus dryophilus:* Radial-longitudinal view of the rot occurring in *Quercus* sp. from Europe and said to be the rot produced by *P. dryadeus*. Fig. 2.—*Polyporus dryadeus:* Cross section of a small root of *Quercus alba* from Maryland, showing the mottled appearance of the diseased wood in the middle stages of the rot. Fig. 3.—*Polyporus dryophilus:* Radial-longitudinal view of the rot appearing in *Quercus alba* from Arkansas, showing the advancing line of rot in a branch. Fig. 4.—*Polyporus dryadeus:* Upper surface of a sporophore on roots of *Quercus texana* from Texas, showing the rough tuberculate pileus. Fig. 5.—*Polyporus dryadeus:* Rot occurring in an apparently sound root of *Quercus alba* from Virginia, showing cross section of a diseased root immediately adjacent to the point of attachment of a large sporophore of *P. dryadeus*, 1 foot high and 1 foot wide. Fig. 6.—*Polyporus dryadeus:* Cross section of a diseased root of *Quercus alba* from Virginia, showing the nearly sound, living upper half of the root and the badly diseased lower half..... 250

XXIII. Parts of sweet-potato plants, showing the presence of pycnidia: *A*, On the stem just above the ground; *B*, on the root..... 274

XXIV. Portion of sweet-potato vines several feet from the hill, showing the results of a natural infection of the foot-rot fungus..... 274

XXV. Microscopic characters of the foot-rot fungus: *A*, Section through a pycnidium on the root; *B*, section through a pycnidium on the stem; *C*, hyphæ, from artificial culture; *D* and *E*, chlamydosporelike bodies found on the host and in some culture media; *F*, pycnospores; *G*, club-shaped bodies often found in pycnidia; *H*, germinating pycnospores..... 274

XXVI. Two sweet-potato plants in pots, demonstrating the parasitism of the foot-rot fungus: *A*, Inoculated; *B*, not inoculated..... 274

XXVII. Nine-day-old cultures on synthetic agar: *A*, The conidial stage of *Diaporthe batatatis; B*, *Plenodomus destruens*.... 274

Page

PLATE XXVIII. Sweet potatoes inoculated with *Plenodomus destruens: A*, Inoculated at the end; *B*, a section of *A* showing extent of rot; *C*, inoculated at the side; *D*, section of *C* showing the extent of rot ..... 274

XXIX. Fig. 1.—A seedling of Hopi maize with mesocotyl 18 cm. long. Fig. 2.—The root system of a plant of Zuni maize dug from a field near Zuni, N. Mex., showing the well-developed, single seminal root and the comparatively feeble nodal roots ..... 302

XXX. Fig. 1.—A hill of Hopi maize containing 15 plants grown under conditions of extreme drought at the base of the First Mesa near Polacca, Ariz. Fig. 2.—A plant of Hopi maize ..... 302

XXXI. Fig. 1.—A field of Zuni maize near Zuni, N. Mex. Fig. 2.—A hill of Zuni maize. Flg. 3.—A hill of Hopi maize making luxuriant growth under conditions of extreme drought ..... 302

XXXII. Fig. 1.—A single plant of Navajo maize grown under irrigation at Shiprock, N. Mex. Fig. 2.—The basal portion of the plant of Navajo maize shown in figure 1, with leaves and husks removed ..... 302

XXXIII. Fig. 1.—Pecan nuts infected with the anthracnose fungus by spraying with a distilled water suspension of conidia, showing the appearance nine days after inoculation. *A*, Four check nuts, two punctured with sterile needle and two unpunctured. *B*, Four nuts inoculated upon the unpunctured surface of the hull. *C*, Four nuts inoculated after puncturing the surface of the hull with a sterile needle. Fig. 2.—Three of the infected nuts shown in figure 1 after further development of the acervuli ..... 338

XXXIV. Yellow Newtown apples infected by needle puncture with conidia of the anthracnose fungus from pecan and apple, showing appearance four days after inoculation. Fig. *A*.—Check apples punctured by sterile needle. Fig. *B*.—Apples infected by needle punctures with strain 150 from the apple. Fig. *C*.—Apples infected with strain 123 from a diseased pecan hull. Fig. *D*.—Apples infected with strain 125 from a diseased pecan hull ..... 338

XXXV. Yellow Newtown apples infected by needle puncture with conidia of the anthracnose fungus from pecan and apple, showing appearance four days after inoculation. Fig. *A*.—Check apple punctured by sterile needle. Fig. *B*.—Apple infected with strain 125 from the pecan nut. Fig. *C*.—Apple infected with strain 123 from the pecan nut. Fig. *D*.—Apple infected with strain 150 from the apple. Fig. *E*.—Apple infected with strain 146 from the pecan leaf. Fig. *F*.—Apple infected with strain 158, a reisolation of strain 125 after passage through the apple .. 338

XXXVI. Crown-gall (caused by *Bacterium tumefaciens* Sm. and Town.) on pecan nursery trees from southern Mississippi. Fig. 1.—The soft type of gall. Fig. 2.—The hard type of gall ..... 338

Page

PLATE XXXVII (colored). Fig. *A*.—A pecan leaflet infected with the brown leaf-spot fungus (*Cercospora fusca*, emend. sp.) from pure culture. Fig. *B*.—A pecan leaflet infected with the anthracnose fungus (*Glomerella cingulata* (Stonem.) S. and v. S.) from pure culture. Fig. *C*.—View of upper surface of a pecan leaflet recently infected with the nursery-blight fungus (*Phyllosticta caryae* Peck) from pure culture. Fig. *D*.—A pecan kernel infected with the kernel-spot fungus (*Coniothyrium caryogenum*, n. sp.) from a pure culture, showing the appearance eight days after inoculation. Fig. *E*.—A pecan kernel with the kernel-spot from natural infection. Fig. *F*.—A pecan nut infected with the anthracnose fungus from pure culture. Fig. *G*.—The nursery-blight fungus upon synthetic agar after two weeks. Fig. *H*.—The nursery-blight fungus on corn-meal agar after two weeks. Fig. *I*.—Views of the upper and lower surfaces of pecan leaflets, showing an advanced stage of the nursery-blight. Fig. *J*.—The brown leaf-spot fungus on synthetic agar after four weeks. Fig. *K*.—The brown leafspot fungus on corn-meal agar after four weeks ..... 338

XXXVIII. An oak (*Quercus gambelii*) inoculated with *Diplodia longispora* at X when dormant ..... 346

XXXIX. Injury caused by potato weevils. Fig. 1.—A section of a potato from Peru, showing the larva of *Rhigopsidius tucumanus* in its burrow. Fig. 2.—A section of a potato, showing the burrowings of *Rhigopsidius tucumanus*..... 352

XL. *Rhigopsidius tucumanus* Heller. Fig. 1.—Dorsal view. Fig. 2.—Ventral view..... 352

XLI. Figs. 1 and 2.—*Premnotrypes solani* Pierce. Fig. 1.—Dorsal view. Fig. 2.—Ventral view. Fig. 3.—*Trypopremnon latithorax* Pierce. Dorsal view..... 352

XLII (colored). Sketch map showing the distribution and relative areas of the different types of vegetation in Tooele Valley, with detail showing depressions covered with salt-flat vegetation alternating with ridges bearing greasewood-shadscale vegetation..... 418

XLIII. Fig. 1.—Salt-flat vegetation bordering Great Salt Lake with a greasewood-shadscale ridge in the foreground, a pure stand of *Salicornia utahensis* at the right and hummocks covered with *Allenrolfea occidentalis* in the background. Fig. 2.—Sagebrush association and islands of Kochia vegetation in the upper part of Tooele Valley..... 418

XLIV. Sagebrush (*Artemisia tridentata*). Fig. 1.—A good stand and growth, showing the typical appearance of this association where the conditions are relatively favorable. Fig. 2.—Plants showing the root habit; photographed at the edge of a deep "arroyo" where the soil had recently caved in.. 418

XLV. Fig. 1.—Sagebrush land which has recently been burned over, showing scattered, dead plants of *Artemisia tridentata* (no living ones), a dense growth of the annual grass *Bromus tectorum*, and scattered plants of *Gutierrezia sarothrae*. Fig. 2.—An advanced stage in succession on sagebrush land which has been under cultivation, with

Page

numerous young plants of *Artemisia tridentata* and a dense herbaceous covering of *Bromus tectorum* and alfilaria (*Erodium cicutarium*). Fig. 3.—Sagebrush reestablished on land which has been in cultivation and the original, undisturbed sagebrush vegetation..... 418

PLATE XLVI. Fig. 1.—Line of contact between the sagebrush association and the Kochia association, showing the characteristically sharp demarcation of the two types. Fig. 2.—A typical view of the Kochia association, with plants rather far apart and very uniform in size and appearance. Fig. 3.—Plants of *Kochia vestita*, 4 or 5 inches high, and the grass *Poa sandbergii*, which is usually associated with the Kochia in land that is not grazed..... 418

XLVII. Fig. 1.—Typical shadscale vegetation, consisting of a nearly pure stand of *Atriplex confertifolia*, showing much dead-wood, as is usually the case, but the stand is denser than in much of the area occupied by this association. Fig. 2.—Transition area between the shadscale and the greasewood-shadscale types of vegetation. Fig. 3.—Salt grass (*Distichlis spicata*) covering the whole of the depression to the right with the exception of a colony of Allenrolfea in the middle distance..... 418

XLVIII. Fig. 1.—Salt-flat vegetation, Allenrolfea community. Fig. 2.—Salt-flat vegetation, showing plants of *Salicornia utahensis*. Fig. 3.—Grass-flat vegetation, Sporobolus-Chrysothamnus community, showing a species of rabbit brush, associated with tussock grass..... 418

XLIX. *Citropsis Schweinfurthii* grafted on grapefruit stock (*Citrus decumana*), showing vigorous growth made in 2½ years.. 436

L. Fig. 1.—Yellow Bellflower apple tree in full bloom on April 16, 1912, showing effect of spraying with a solution tion of nitrate of soda plus caustic potash on February 2 previous. Fig. 2.—Unsprayed check tree for comparison with figure 1..... 444

LI. Fig. 1.—A branch from a Yellow Bellflower tree in full bloom on April 10, 1913, showing the effect of spraying with a solution of nitrate of soda plus caustic soda on February 3 previous. Fig. 2.—A branch from an unsprayed check tree for comparison with figure 1..... 444

LII. Fig. 1.—Split radial face of a creosoted hickory block, showing tyloses in a large vessel. Fig. 2.—Tangential section of *Aesculus octandra* (yellow buckeye), showing two tyloses which have grown out of one medullary-ray parenchyma cell. Fig. 3.—Cross section of valley oak, a white oak, showing young tyloses next the bark in vessels..... 470

LIII. Fig. 1.—Cross section of a white oak, showing fully developed tyloses in the large vessels. Fig. 2.—Radial-longitudinal view, quarter-sawed surface, of the white oak shown in figure 1, showing complete closing of the vessel. Fig. 3.—Cross section of sapwood of pignut hickory, showing fully developed tyloses. Fig. 4.—Radial view of mesquite, showing "gum" droplets and formation often stimulating tyloses..... 470

Page

PLATE LIV. Cross section of cow oak, a white oak, showing normal and abnormal tyloses. Fig. 1.—Wound tyloses induced by the felling of the tree and the sudden cessation of sap flow. Fig. 2.—No tyloses; empty vessels. Fig. 3.—Young and well-developed normal tyloses..... 470

LV. Fig. 1.—Cross section of a diffuse porous wood, yellow poplar or tulip, showing scattered tyloses. Fig. 2.—Cross section of a ring porous wood, osage orange, with vasicentric parenchyma, showing abundantly developed tyloses..... 470

LVI. Fig. 1.—Cross section of western white pine, showing ray tyloses, closed vertical resin canal in young sapwood, and nuclei visible in epithelial cells of canal which is beginning to split open. Fig. 2.—Tangential section of Norway pine, showing ray tyloses..... 470

LVII. Fig. 1.—Cross section view of shortleaf pine, showing open and partly closed vertical resin canals. Fig. 2.—Heartwood of Sitka spruce, showing closed vertical canal..... 470

LVIII. Open and closed horizontal canals in sapwood. Fig. 1.—Open canal in tamarack. Fig. 2.—Partly closed canal with distended epithelial cells in Douglas fir. Fig. 3.—Young canal which has never opened in western white pine. Fig. 4.—Open canal in red spruce surrounded by thick-walled epithelium. Fig. 5.—Partly closed canal in red spruce. Fig. 6.—Closed canal in Engelmann spruce..... 470

LIX. Fig. 1.—Log from collection of woods in the Forest-Products Laboratory—a specimen of the material used in this study. Fig. 2.—Specimens of woods showing creosote penetrance in sapwood and heartwood as affected by tyloses. Specimen A.—Red oak. Specimen B.—White oak. Specimen C.—Pignut hickory..... 470

LX. Fig. 1.—River birch with bark removed, showing larval mines of *Agromyza pruinosa*. Fig. 2.—Section through wood of river birch, showing "pith-ray flecks" produced by the work of *Agromyza pruinosa*..... 474

LXI. Fig. 1.—*Agromyza pruinosa:* Larva and details. Fig. 2.—*Agromyza pruinosa:* Pupa. Fig. 3.—*Agromyza pruinosa:* Adult male. Fig. 4.—*Agromyza pruinosa:* Abdomen of adult female, showing ovipositor. Fig. 5.—*Sympha agromyzae:* Adult..... 474

LXII. Fig. 1.—Wheat seedlings from seed inoculated with spores of *Helminthosporium gramineum* and from seed externally sterilized. Fig. 2.—Barley seedlings from seed inoculated with *Helminthosporium gramineum* and from sterilized seed. Fig. 3.—Wheat seedlings from seed inoculated with spores of *Fusarium culmorum* from oat seedlings and from seed externally sterilized. Fig. 4.—Barley seedlings from seed inoculated with spores of *Fusarium culmorum* from oat seedlings and from seed externally sterilized. Fig. 5.—Oat seedlings from seed inoculated with spores of *Fusarium culmorum* from oat seedlings and from seed externally sterilized..... 490

Page

PLATE LXIII. Root systems of wheat seedlings grown in 6-inch pots from seed externally sterilized and from seed inoculated with *Helminthosporium gramineum* from wheat ..... 490

TEXT FIGURES

Citrus Ichangensis, a Promising, Hardy, New Species from Southwestern China and Assam.

FIG. 1.—*Citrus ichangensis*, n. sp.: *A*, Pistil after the petals and stamens have dropped but before the style has fallen off; *B*, stamen as seen from one side; *C*, two seeds deformed by mutual pressure .. 1
2.—*Citrus ichangensis*, n. sp.: Fruit showing the very low, broad, apical papilla circumscribed by a shallow furrow ..... 2
3.—*Citrus ichangensis*, n. sp.: *A*, Cross section of a large fruit; *B*, seeds .. 3
4.—*Citrus ichangensis:* *A*, Calyx of dwarf wild form and pedicel with bracts; *B*, young fruit; *C*, flower bud and pedicel with bracts .. 4
5.—*Citrus ichangensis:* Flowering branch from the type specimen .... 5
6.—*Citrus ichangensis:* Flowering branch of dwarf wild form ..... 6
7.—*Citrus ichangensis:* Flowering branch from a paratype in the herbarium of the Arnold Arboretum ..... 7

Cysticercus Ovis, the Cause of Tapeworm Cysts in Mutton:

FIG. 1.—*Cysticercus ovis:* Hooks ..... 17
2.—*Cysticercus ovis:* Head and neck ..... 18
3.—*Cysticercus oviparíens* (=*C. ovis*): Fragment of head ..... 19
4.—*Cysticercus oviparíens* (=*C. ovis*): Hooks ..... 19
5.—*Cysticercus oviparíens* (=*C. ovis*): Papillæ on caudal bladder ... 29
6.—Hooks of *Taenia ovis*, *T. hydatigena*, *T. solium*, *T. balaniceps*, and *T. krabbei* ..... 30
7.—Sexually mature segment of *Taenia ovis* ..... 31
8.—Sexually mature segment of *Taenia hydatigena* ..... 31
9.—Gravid segment of *Taenia ovis* ..... 32
10.—Gravid segment of *Taenia hydatigena* ..... 32
11.—Surface of caudal bladder of *Cysticercus ovis* showing papillæ .. 33
12.—Surface of caudal bladder of *Cysticercus tenuicollis* showing transverse furrows ..... 33
13.—*Cysticercus oviparíens* (=*C. ovis*): *a*, Hook; *b*, cyst containing cysticercus cut across ..... 38

The Serpentine Leaf-Miner:

FIG. 1.—The serpentine leaf-miner (*Agromyza pusilla*): *a*, Adult; *b*, side view of head; *c*, side view of thorax, showing characteristic color pattern; *d*, dorsal view of abdomen, melanic phase; *e*, outline of thorax, showing location of characteristic bristles ... 59
2.—Map showing known distribution of the serpentine leaf-miner throughout the world ..... 61
3.—Map showing distribution of the serpentine leaf-miner within the United States ..... 62
4.—Alfalfa leaf with eggs of the serpentine leaf-miner in situ. *a*, Egg, greatly enlarged; *b*, same, in situ, with parenchyma of leaf partly dissected away ..... 66
5.—Larva of the serpentine leaf-miner, lateral view ..... 68
6.—Puparium of the serpentine leaf-miner, ventral view ..... 68
7.—Mouth armature of larva of the serpentine leaf-miner ..... 70
8.—Diagram showing the range in temperature throughout the year at three widely separated localities at which observations were made on the serpentine leaf-miner ..... 73
9.—*Diaulinus begini*, a parasite of the serpentine leaf-miner. At left, hind leg of *Diaulinus websteri* ..... 78
10.—Larva of *Diaulinus begini* ..... 79
11.—Pupa of *Diaulinus begini* ..... 79
12.—*Chrysocharis parksi*, a parasite of the serpentine leaf-miner. *a*, Middle and hind legs of *Chrysocharis ainsliei* ..... 80
13.—*Zagrammosoma multilineata*, a parasite of the serpentine leaf-miner ..... 81

The Serpentine Leaf-Miner—Continued: Page

FIG. 14.—*Pleurotropis rugosithorax*, a parasite of the serpentine leaf-miner. 81
15.—*Agromyza angulata*. 84
16.—Puparium of *Agromyza angulata*, with lateral view of anal appendages at left. 84
17.—*Agromyza coquilletti*. 85

The Occurrence of a Cotton Boll Weevil in Arizona:

FIG. 1.—*Anthonomus grandis*, var. *thurberiae:* Prothorax. 91
2.—*Anthonomus grandis* Boh.: Prothorax. 91
3.—*Anthonomus grandis*, var. *thurberiae:* Head and beak: *A*, Female; *B*, male. 92
4.—*Anthonomus grandis* Boh.: Head and beak: *A*, Female; *B*, male. 92
5.—*Anthonomus grandis*, var. *thurberiae:* Antenna of female. 93
6.—*Anthonomus grandis* Boh.: Antenna of female. 93
7.—*Anthonomus grandis*, var. *thurberiae: A*, Front leg; *B*, middle leg; *C*, hind leg. 94
8.—*Anthonomus grandis* Boh.: *A*, Front leg; *B*, middle leg; *C*, hind leg. 94
9.—*Anthonomus grandis*, var. *thurberiae:* Wing. 95

Individual Variation in the Alkaloidal Content of Belladonna Plants:

FIG. 1.—Diagram showing the percentage of alkaloids in the leaves of individual belladonna plants at the Arlington Experimental Farm, Va., during the seasons of 1911 and 1912. 144

The Pubescent-Fruited Species of Prunus of the Southwestern States:

FIG. 1.—Map of the southwestern part of the United States, showing the range of *Prunus andersonii*, *Prunus fasciculata*, and *Prunus eriogyna*, n. sp. 149
2.—Map of Texas, showing the known areas and probable range of *Prunus minutiflora* and *Prunus texana*. 151
3.—*Prunus texana* Dietr.: *A*, Section of calyx; *B*, detail of calyx lobes, showing glandular margins; *C*, section of calyx from flower of the horticultural variety Ramsey, *P. texana* × Wild Goose plum. 155
4.—*Prunus andersonii* Gray: *A*, Petal; *B*, section of a flower; *C*, calyx showing ciliate margins; *D*, *E*, dried fruit; *F*, *G*, stone. 165
5.—*Prunus eriogyna*, n. sp.: *A*, Section of calyx; *B*, detail of portion of calyx with petals, from outside, showing glandular ciliation of lobes; *C*, twig showing angular habit of branching, leaves and fruit attached. 169
6.—*Prunus fasciculata* Gray: *A*, Section of staminate flower, showing abortive ovary and minute hairs on interior of calyx; *B*, calyx cup, pistillate form, showing abortive stamens; *C*, detail of calyx lobe; *D*, fecundated ovary; *E*, *F*, *G*, fruits, three forms; *H*, *I*, *J*, seed, dorsal, ventral, and side views 171
7.—*Prunus minutiflora* Engelm.: *A*, Section of flower of pistillate form, showing well-developed pistil and abortive stamens; *B*, section of flower, staminate form, showing well-developed stamens and abortive pistil; *C*, detail of calyx lobes and petals. 173
8.—*Prunus microphylla* Hems.: *A*, Section of staminate flower, showing well-developed stamens and abortive pistil; *B*, detail of calyx from outside; *C*, twigs showing leaves and fruit; *D*, fecundated ovary. 176

Selective Adsorption by Soils:

FIG. 1.—Curves showing the effect of concentration on the selective adsorption of potassium from solutions of potassium by Norfolk sandy loam and by Marshall silt loam. 185
2.—Curves showing the effect of the presence of sodium nitrate and calcium phosphate on the selective adsorption of potassium from solutions of potassium chlorid. 187

A Bacterium Causing a Disease of Sugar-Beet and Nasturtium Leaves:

FIG. 1.—*Bacterium aptatum* from a 2-day beef-bouillon culture stained with carbol fuchsin 195
2.—Filaments of *Bacterium aptatum* taken from the condensation water from a 2-day-old agar culture; stained with carbol fuchsin: *a*, Segmented; *b*, unsegmented 195

A Bacterium Causing a Disease of Sugar-Beet and Nasturtium Leaves—Contd.: Page

FIG. 3.—Process of cell division as seen in an 18-hour-old hanging drop culture of *Bacterium aptatum*..... 195
4.—*Bacterium aptatum* showing flagella from a 2-day-old agar culture; stained with Loeffler's flagella stain..... 196
5.—Camera-lucida drawing of a portion of a cross section of sugar-beet leaf inoculated with *Bacterium aptatum*..... 206

The Calliephialtes Parasite of the Codling Moth:

FIG. 1.—*Calliephialtes* sp.: Ventral view of terminal abdominal segments, showing relative position of elements of ovipositor. *a*, Valves of sheath; *b*, lance; *c*, lancets; *d*, cerci..... 216
2.—*Calliephialtes* sp.: Lateral view of terminal abdominal segments, showing relative position of elements of ovipositor. *a*, Valves of sheath; *b*, lance; *c*, lancets; *d*, cerci..... 216
3.—*Calliephialtes* sp.: Lateral view of tips of elements of ovipositor. *a*, Sheath; *b*, lance; *c*, lancet..... 217
4.—*Calliephialtes* sp.: Ventral view of male genitalia. *a*, Sheath; *b*, penis; *c*, clasper; *d*, genital palpus; *e*, cardo..... 217
5.—*Calliephialtes* sp.: Ventral view of clasping organ of male genitalia. *a*, Basal portion; *b*, clasper; *c*, genital palpus..... 217
6.—*Calliephialtes* sp.: Egg..... 219
7.—Diagram showing relation between incubation period of eggs of *Calliephialtes* sp. and average mean temperature at Vienna, Va., 1912..... 220
8.—*Calliephialtes* sp.: Dorsal view of newly hatched larva..... 221
9.—*Calliephialtes* sp.: Ventral view of head of newly hatched larva.. 221
10.—*Calliephialtes* sp.: *a*, Full-grown larva; *b*, face..... 221
11.—Diagram showing relation between temperature and larval period of males and females of *Calliephialtes* sp. in the cocoon at Vienna, Va., 1912..... 224
12.—*Calliephialtes* sp.: Prepupa of female..... 225
13.—*Calliephialtes* sp.: Beginning of exuviation of female pupa..... 226
14.—*Calliephialtes* sp.: Pupa of female and tip of abdomen of male pupa..... 226
15.—Diagram showing relation between pupal period of *Calliephialtes* sp. and temperature..... 228

The Foot-Rot of the Sweet Potato:

FIG. 1.—Graphic representation of growth on rice at different temperatures. 270

A Drought-Resisting Adaptation in Seedlings of Hopi Maize:

FIG. 1.—Diagram of seedling maize plant, giving terminology of parts.... 294
2.—Diagram showing the average size of seedlings of Chinese, Boone County White, and Navajo maize planted at different depths.. 296

Some Diseases of Pecans:

FIG. 1.—Cross section of pecan leaf recently infected with the nursery-blight fungus (*Phyllosticta caryae* Peck)..... 306
2.—Horizontal section of leaf recently infected with the nursery-blight fungus..... 311
3.—Cross section of a leaf infected with the brown leaf-spot fungus.. 314
4.—Diagram showing measurements in length of 200 conidia..... 318
5.—Diagram showing measurements in width of 200 conidia..... 319
6.—The anthracnose fungus upon corn-meal agar: *A*, Acervulus; *B*, conidia; *C*, ascus..... 328
7.—Diagram showing ascospore measurements of the anthracnose fungus: *A*, Length of 150 ascospores; *B*, width of 150 ascospores. 328
8.—Diagram showing conidial measurements of the anthracnose fungus: *A*, Length of 150 conidia; *B*, width of 150 conidia..... 329

A Twig Blight of Quercus Prinus and Related Species:

FIG. 1.—*Diplodia longispora:* A section of a pycnidium..... 340
2.—*Diplodia longispora:* Stages in development of spore. *A*, Macrophoma stage; *B*, Diplodia stage; *C*, Diplodia spore with two septa..... 340
3.—*Diplodia longispora:* Sclerotial bodies formed in artificial media. 343
4.—*Diplodia longispora:* A section showing grouping of pycnidia... 344

A Twig Blight of Quercus Prinus and Related Species—Continued: Page

FIG. 5.—*Diplodia longispora:* Types of germination. *A*, *B*, Germ tubes from end of spore; *C*, germ tube from side of spore ..... 344
6.—*Diplodia longispora:* A portion of mycelium showing the coalescing of the hyphæ ..... 345
7.—*Diplodia longispora:* A portion of mycelium with chlamydospore-like bodies ..... 345

New Potato Weevils from Andean South America:

FIG. 1.—*Premnotrypes solani* Pierce: Lateral view of prothorax and beak. 348
2.—*Premnotrypes solani* Pierce: Frontal view of beak ..... 348
3.—*Trypopremnon latithorax* Pierce: Lateral view of thorax and beak. 349

Indicator Significance of Vegetation in Tooele Valley, Utah:

FIG. 1.—Curve showing the relation between the salt content (in percentages of the dry weight of the soil) and the specific electrical resistance (in ohms) of the soil when saturated with water ..... 368
2.—Monthly distribution of precipitation at Tooele, Utah (mean for 15 years) ..... 369
3.—A representative 10-meter quadrat of the sagebrush association, showing the location of each individual of *Artemisia tridentata* and of *Gutierrezia sarothrae*, these being the only woody species present ..... 379
4.—*Artemisia tridentata* (sagebrush): *A*, Detail showing the wedge-shaped, 3-toothed leaves by which this plant is easily recognized; *B*, a small plant growing where hardpan occurred, showing the deflection of the taproot from a vertical to a horizontal direction after reaching a depth of 5 inches ..... 381
5.—A small plant of sagebrush (*Artemisia tridentata*), showing the deeply penetrating taproot and good development of superficial lateral roots typical of this species ..... 384
6.—A representative 10-meter quadrat of the Kochia association, showing the location of each tuft of Kochia and of each matlike colony of *Poa sandbergii* ..... 390
7.—*Kochia vestita: A*, Detail showing the narrow, hairy leaves; *B*, a plant showing the shallow root system and the propagation by root shoots ..... 392
8.—A representative 10-meter quadrat of the shadscale association, showing the location of each individual plant of *Atriplex confertifolia*, the only woody species present, and of *Opuntia* sp.. 395
9.—*Atriplex confertifolia* (shadscale): *A*, A typical plant, showing the thick, vertical taproot and the widespreading lateral roots; *B*, detail of a fruiting branch, showing the shape of the leaves and of the bracts, or scales, which envelop the fruits ..... 398
10.—*Sarcobatus vermiculatus* (greasewood): *A*, Detail showing the narrow, rather fleshy leaves; *B*, a plant showing the excellent root development ..... 404
11.—*Allenrolfea occidentalis: A*, Detail of a fruiting branch, showing the cylindrical, fleshy, practically leafless stems; *B*, a plant showing the large taproot and rather scanty lateral roots characteristic of this species ..... 409
12.—A representative 10-meter quadrat of the Allenrolfea community (salt-flat association), showing the location of each individual plant of *Allenrolfea occidentalis*, the only species present ..... 410
13.—Diagram showing the characteristic root development of the dominant species of each of the principal types of vegetation of Tooele Valley and indicating the average conditions of soil moisture and salinity of the corresponding types of land ..... 412

Citropsis, a New Tropical African Genus Allied to Citrus:

FIG. 1.—*Citropsis Schweinfurthii:* A branch showing 3-foliate and 5-foliate leaves, leaflike petioles, and rachis segments; also paired and single spines in the axils of the leaves ..... 419
2.—*Citropsis Schweinfurthii:* Young seedlings germinated in Washington, D. C., from seed from Budongo Forest, Uganda, Africa. *A*, Young seedling, showing the first pair of leaves, succeeded by alternate simple leaves, and finally unifoliate leaves; *B* and *D*, young seedlings, showing the first foliage leaves, which are opposite; *C*, a single one of the pair of first foliage leaves ..... 422

Citropsis, a New Tropical African Genus Allied to Citrus—Continued: Page

3.—*Citropsis Preussii:* Flowers after petals and stamens have fallen; leaves, one trifoliate and one having the terminal leaflet borne on a winged segment of the rachis. 424

4.—Pistils of four species of Citropsis. *A*, *Citropsis Preussii; B*, *Citropsis mirabilis; C*, *Citropsis Schweinfurthii;* and *D*, *Citropsis gabunensis* 425

5.—*Citropsis Schweinfurthii:* Nearly mature fruit; *A*, side view, showing calyx and disk; *B*, section showing four cells with pulp vesicles and three seeds 427

6.—*Citropsis Schweinfurthii:* Cluster of flowers, showing stamens arranged to form a staminal tube 429

7.—*Citropsis Schweinfurthii:* A trifoliate leaf from the type specimen, showing double spines in the axils and pronounced serrations of the leaflets toward the tips 430

The Origin of Some of the Streptococci Found in Milk:

FIG. 1.—Cells of streptococci, showing variation in size and morphology 494

2.—Types of cells of streptococci 495

3.—Curve showing the typical rate of fermentation of dextrose and glycerin 496

4.—Frequency curves showing acid formation in dextrose broth 502

5.—Graphic representation of the characters of cultures of streptococci from milk and from bovine feces 503

6.—Graphic representation of the characters of cultures of streptococci from the mouths of cows and from infected udders 504

7.—Diagram showing the fermentation reactions of two types of udder cultures of streptococci 506

8.—Diagram showing a possible grouping of the milk cultures of streptococci 507

## *FOREWORD*

*The recent advances in the theory and practice of agriculture have come almost entirely from scientific research applied to agricultural problems. Accumulated results of centuries of painstaking studies have been drawn upon, and it has become evident that further improvement in agriculture calls for continued investigation of the most accurate and thorough nature. The first recognition of the economic value of progress in these investigations as well as the initial application of theories to practical problems comes usually from specialists. Indeed, only in rare instances is the significance of the results of scientific research apparent to farmers, since newly discovered facts are seldom directly applicable to agricultural conditions.*

*The suggestive or the indirect value of reports of new work is usually of paramount economic importance; it is the purpose of the Journal of Agricultural Research, therefore, to record investigations bearing directly or indirectly upon economic conditions of agriculture. It is hoped that permanence of record of new data may be secured by sending the Journal in its entirety to special libraries and institutions which make suitable exchanges and that a liberal distribution of the reprinted papers to interested specialists may enhance the usefulness of the separate articles.*

*The first few issues will contain papers from the Department of Agriculture only. Plans, however, are now being perfected in accordance with the tentative suggestions made to the Secretary of Agriculture by the executive committee of the Association of American Agricultural Colleges and Experiment Stations so that articles prepared and submitted by investigators in the State agricultural colleges and experiment stations will eventually be included in the Journal.*

*B. T. GALLOWAY,*
*Assistant Secretary of Agriculture.*

*Washington, D. C.,*
*October 1, 1913.*